CLAIMS

1. In an optical disk device including light beam irradiating means for irradiating light beam to an optical disk, a plurality of photodetecting means for detecting reflected light or transmitted light of light beam from the optical disk, error source signal generating means for generating two signals to be sources of an error signal from a plurality of outputs from the photodetecting means, and focus monitoring means for supplying a signal indicating a focused mode or an unfocused mode of the light beam from plural outputs from the photodetecting means, an error signal generation device that generates an error signal from outputs from the error source signal generating means, comprising:

adjusting means for applying a gain and an offset to two signals, which are to be sources of an error signal, from the error source signal generating means;

balance operation means for performing a differential operation by applying a gain balance to two outputs from the adjusting means;

signal measuring means for measuring the two outputs from the adjusting means;

offset amount learning means for measuring an offset amount in the unfocused mode of the two outputs of the adjusting means offset from an operation reference level of the balance operation means, according to a signal indicating a light beam convergence state from the focus monitoring means and measured results of the signal measuring means;

balance correction value adjusting means for determining a correction value in the balance operation according to information on a valance value from the balance operation means and the offset amount in the unfocused mode from the offset amount learning means; and

balancer correction means for adding information on the correction value of the balance correction value adjusting means to an output of the balance operation means.

2. The error signal generation device of Claim 1, wherein

a dynamic range (D range) on an output side of the adjusting means immediately thereafter is limited to a given range, and two outputs of the adjusting means in the focused mode and in the unfocused mode are adjusted according to a signal indicating a light beam convergence state from the focus monitoring means so as to fall within a D range on an input side of the balance operation means.

3. The error signal generation device of Claim 2, wherein

the limitation of the D range on the input side of the balance operation means is generated from an input side D range of an A/D converter.

4. The error signal generation device of Claim 2, wherein

the offset amount learning means adjusts an offset and a gain of the adjusting means twice in the focused mode and in the unfocused mode, and calculates an offset amount of a signal offset in the unfocused mode with the gain and the offset in the focused mode according to the offset amount in the unfocused mode and the set gains and offsets of the adjusting means in the focused mode and in the unfocused mode.

5. The error signal generation device of Claim 4, wherein

the offset amount learning means sets a gain and an offset in the focused mode so that an output signal of the adjusting means in the unfocused mode exceeds an output D range of the adjusting means.

6. The error signal generation device of Claim 5, wherein

the balance correction value adjusting means sets, using two outputs (a, b) of the offset amount learning means and a balance value (Bal) of the balance operation means, a correction value in the balance operation to a(1+Bal)-b(1-Bal).

7. The error signal generation device of Claim 5, wherein

the balance correction value adjusting means sets, using two outputs (a, b) of the offset amount learning means and a balance value (Bal) of the balance operation means, a correction value in the balance operation to Bal(a+b)+(a-b).

8. The error signal generation device of Claim 5, wherein

when two outputs (a, b) of the offset amount learning means are sufficiently great and a difference between a and b is small, the balance correction value adjusting means sets, using a balance value (Bal) of the balance operation means, a correction value in the balance operation to Bal(a+b).

9. The error signal generation device of Claim 5, wherein

the balance correction value adjusting means applies same gain and offset values of the adjusting means to two inputs thereof so as to set two outputs of the offset amount learning means as a common value (a), and sets, using the balance value (Bal) of the balance operation means, a correction value in the balance operation to $2 \times Bal \times a$.

10. The error signal generation device of Claim 4, wherein

the signal measuring means measures a mean value of output signals of the adjusting means in the unfocused mode and in the focused mode, and

the offset amount learning means determines an offset value of the adjusting means so that the thus measured mean value becomes an operation reference level of the balance operation.

11. The error signal generation device of Claim 10, wherein

the signal measuring means measures a time average of output signals of the adjusting means in the unfocused mode and in the focused mode and sets the thus

measured time average as a mean value of the output signal of the adjusting means.

12. The error signal generation device of Claim 10, wherein

the signal measuring means measures a maximum value and a minimum value of output signals of the adjusting means in the unfocused mode and in the focused mode, and sets an intermediate value between the thus measured maximum and minimum values as a mean value of the output signals of the adjusting means in the focused mode.

13. The error signal generation device of Claim 10, wherein

the signal measuring means measures a maximum value and a minimum value of output signals of the adjusting means in the unfocused mode and in the focused mode within a given time period, performs this measurement plural times, and sets an intermediate value of respective averages thereof as a mean value of the output signal of the adjusting means in the focused mode.

14. The error signal generation device of Claim 4, wherein

the signal measuring means measures amplitude of an output signal of the adjusting means in the focused mode, and the offset amount learning means determines a gain value of the adjusting means so that the amplitude of the output signal of the adjusting means in the focused mode becomes a given rate with respect to the D range on an output side of the adjusting means immediately thereafter.

15. The error signal generation device of Claim 14, wherein

the offset amount learning means determines a gain value of the adjusting means according to a ratio between the amplitude of the output signal of the adjusting means and the D range on the output side of the adjusting means immediately thereafter.

16. The error signal generation device of Claim 14, wherein

the offset amount learning means adjusts a gain value of the adjusting means in a manner that the gain value of the adjusting means is set to be minimum and the gain value of the adjusting means is increased gradually until amplitude of an output signal of the adjusting means thereafter exceeds a given ratio of the D range on the output side of the adjusting means immediately thereafter.

17. The error signal generation device of Claim 15 or Claim 16, wherein

the signal measuring means measures a maximum value and a minimum value of output signals of the adjusting means in the focused mode and sets a difference between the maximum value and the minimum value as the amplitude of the output signal of the adjusting means.

18. The error signal generation device of Claim 15 or Claim 16, wherein

the signal measuring means measures a maximum value and a minimum value of output signals of the adjusting means in the focused mode within a given time period, performs this measurement plural time to obtain respective mean values of the maximum values and the minimum values, and sets a difference between the respective mean values as the amplitude of the output signal of the adjusting means.

19. The error signal generation device of Claim 14, wherein

the offset amount learning means determines a gain value of the adjusting means so that amplitude of an output signal of the adjusting means in the focused mode becomes about 80 % of the D range on the output side of the adjusting means immediately thereafter.

20. The error signal generation device of Claim 4, wherein

a gain value of the adjusting means is determined beforehand according to a kind of a medium used in the optical disk.

21. The error signal generation device of Claim 4, wherein

when there is an error between the set gain and offset values of the adjusting means and actual gain and offset amounts, the offset amount learning means performs calibration of gain and offset amounts by adjusting the set gain and offset values of the adjusting means.

22. The error signal generation device of Claim 21, wherein

a gain variation amount with respect to the set gain value is calculated in a manner that the offset amount learning means changes a gain of the adjusting means in the unfocused mode while the offset amount is fixed, and the signal measuring means measures variation in mean values of output signals of the adjusting means.

23. The error signal generation device of Claim 21, wherein

an offset variation amount with respect to the set offset value is calculated in a manner that the offset amount learning means changes an offset of the adjusting means in the unfocused mode while the gain amount is fixed, and the signal measuring means measures variation in mean values of output signals of the adjusting means.